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Complete Vehicle

Model: E70/E71 M

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Compare the series production E70 X5 and E71 X6 with the E70 M and the E71 M
- Compare the N63 engine to the new S63 powerplant installed in the X5 M and X6 M
- Identify the M specific powertrain components of the E70 M and E71 M
- Describe the new M tuned chassis systems on the E70 M and E71 M
- Identify the new features of the CIC

Introduction

The BMW M family has been enhanced with the addition of the E70 M and E71 M. The BMW X5 M and X6 M were launched on to the US market in September of the 2009.

The then BMW “Motorsport” was established in 1972 with the legendary M1. For over 30 years today’s BMW M GmbH has been developing BMW M vehicles with a motor-sport pedigree based on the standard production models.

To date, the BMW 3 Series, Z Series, 5 Series and the 6 Series have been crowned with at least one M model. With the BMW X5 M and BMW X6 M, for the first time, X Series models will join this elite list of M performance vehicles.

These models are the first M cars to be equipped with the M TwinPower turbo engine and the M Sport automatic transmission as well as xDrive, Dynamic Performance Control, Dynamic Drive and run flat tires.



The X5 M and X6 M are the benchmark in terms of dynamics, agility and emotion in the High Performance Sports Activity Vehicle/Sports Activity Coupe class.

Characteristic features of the E70/E71 M:

- The overall body design concept of the series production vehicle was aerodynamically perfected to meet the M specific characteristics.
- The engine and transmission combination delivers even more power and spontaneous linear performance, with two engine dynamics control programs (power and economy). The M specific gearshift characteristics (without Drive Logic program) produce fast and precise gear changes.
- Distinctly sporty engine sound, both in the lower and in the higher engine speed ranges.
- The M Servotronic steering is taut, direct and precise. The M steering wheel with M shift paddles and M mode button are standard equipment.
- The chassis and suspension were especially setup to develop a sporty stiff suspension but without excessively hard rolling characteristics, even in sport mode. The result is an optimized interaction of the steering, suspension and damping that enhances vehicle handling.
- M Dynamic Mode (MDM) is installed instead of Dynamic Traction Control (DTC). Rear end-orientated xDrive setup is defaulted to when driving enthusiastically in MDM and DSC-OFF mode.
- The M seats with high quality upholstery in BMW Merino leather offer optimum seat comfort.
- BMW Merino leather, M instrument cluster, M drive menu, M head-up display, M seat, M specific trim strips, M foot rests and sill panel trim all add to the interior ergonomics of these vehicles.

BMW Efficient Dynamics measures:

- High Precision Injection (gasoline direct fuel injection).
- Automatic transmission with optimized torque converter lockup clutch (Double- Damper) and increased efficiency by early up-shifting the transmission in the "Efficient" program.
- Dynamic Drive (QMVH) with hydraulic supply system featuring controlled volumetric flow.
- A/C compressor with magnetic clutch.
- Fuel pump with requirement-orientated (PWM) control.

E70/E71 M comparison with series production models

Description	Unit	E70M	E71M	E71 xDrive50i	E70 xDrive48i
Engine series, V8		S63B44O0	S63B44O0	N63B44O0	N62B48O1
Engine management		MSD85.1	MSD85.1	MSD85	ME9.2.3
Transmission type designation		6HP26S	6HP26S	6HP26TU	6HP26TU
Length	mm (inch)	4851 (191)	4876 (192.96)	4877 (192)	4854 (191.1)
Width	mm (inch)	1994 (78.5)	1983 (78.1)	1983 (78.1)	1933 (76.1)
Height	mm (inch)	1764 (69.4)	1684 (66.3)	1690 (66.5)	1776 (69.9)
Wheelbase turning circle	mm (inch) m (ft)	2933 (115.5) 12.8 (42)	2933 (115.5) 12.8 (42)	2933 (115.5) 12.8 (42)	2933 (115.5) 12.8 (42)
Number of seats (X5 with third row of seats)		5	4	4	5 (7)
Luggage compartment capacity	[ltr]	620-1750	570-1450	570-1450	620-1750
Steering		Rack and pinion power steering with Servotronic		Rack and pinion power steering	
Overall steering ratio		19.5 :1	19.5 :1	19.5 :1	19.5 :1
Lock to lock turns		3.11	3.11	3.11	3.11
Final drive ratio		3.91:1	3.91:1	3.64 :1	3.91:1
Top speed - * SA840 Increased top speed limiter	km/h (mph)	250 (155)	250 (155)	210 (130) 250 (155)*	210/130 250 (155)*
Acceleration 0-60 mph	[s]	4.5	4.5	5.3	6.4
1000m, standing start	[s]	23.9	23.9	24.6	26.6
Engine horse power out- put at engine speed	kW (bhp) [rpm]	414 (555) 5750-6250	414 (555) 5750-6250	300 (400) 5500-6400	261 (350) 6300
Engine torque output at engine speed	Nm (ft lbs) [rpm]	680 (500) 1500-5650	680 (500) 1500-5650	610 (450) 1750-4500	475 (350) 3400-3800
Power-to-weight ratio	[lbs/hp]	9.7	9.6	13.2	15.0
Curb weight	kg (lbs)	2435 (5368)	2415 (5324)	2390 (5269)	2380 (5247)

Body

Front Section

The new intake air duct and the mounting arrangement for the new intake silencer is identical for the E70 M and the E71 M.

A new extruded aluminum section cross member with two additional brackets, is installed for mounting the intake silencer to the body.



Front Bumper

The single-piece lower bumper panel is identical on the E70 M and on the E71 M and features M characteristic spoiler flaps that maximize air flow and enhanced down force in the front section. The standard PDC sensors, and bumper cover are painted to match the exterior color. The kidney grilles have a black structured finish.

Note: Fog lights are not offered on E70 M or E71 M.



Cooling Air Intake

The new air duct is identical for the E70 M and the E71 M.

A new air routing system was designed for the engine radiator and system coolers. Multifunction air routing combines:

- the air duct for brakes,
- air duct for auxiliary radiator,
- air duct for the engine oil cooler and
- air duct for additional low temperature cooler.

Side Gills

The familiar M gills with integrated turn signal repeater and M logo are a distinctive design feature on the left and right front fenders (similar in design to the E92 M3). Although the lamp itself and the M logo are common parts, the design of the M gill is different on the E70 M compared to the E71 M.

On the E70 M, the gill is integrated directly into the front fender. On the E71 M, the gill is a separate painted trim piece with additional design elements. Unlike on the current M5 and M3, these side M gills are non-functional air vents.



E70/E71 M gill element in front fender

Outside Mirrors

The exterior mirrors feature an M specific contour and mirror cap. The electrochromic exterior mirrors are heated as standard. They have a memory and fold-in function as well as automatic curb monitor for the passenger's side mirror. The new M design mirror caps are painted to match the vehicle's exterior color.

With the introduction of E70 M and E71 M the top rear side view camera (TRSVC) is available for the first time in the US market. Option 3AH (Rear View Camera w/ Top View) is offered as part of the ZDA Driver Assistance Package.

Top view camera option adds cameras to the out side mirrors (see arrow in the graphic). The mirror mounting carriers are specially adapted to accommodate the LVDS cable of the camera system.

The Top view cameras are connected to the TRSVC control unit and work in conjunction with the rear view camera and Park Distance Control (PDC). They can be turned on by pressing the PDC button or are automatically turned on when the vehicle is placed in reverse.

The top view cameras have the same adjustment options as the rear view camera.

Parking aid line assistance is available for the top view camera and can be selected from the top/rear view menu screen (See lower left graphic).

The customer can choose between a “three way split view” that displays left, right and rear views in one image or the single view by selecting just the rear view camera image to be displayed in the CID.



E71 M left side mirror with top view camera



E70 M

Front Fenders

The front fender is a newly designed component which resembles the E71 fender at the front and the E70 at the rear (near the doors). The headlights are adopted from the E71. The headlight washer system is fitted as standard (also taken from the E71).



E70 M Side View

Wheel Arch Trim/wheel Arch Cover and Rims

The wheel arch trim at the front and rear is similar to that of the E70 (M Sport Package). It is painted and adapted to the geometry of the front fenders at the front and the geometry of the wheel arch cover at the rear.

The front wheel arch cover and front brake air ducts are adopted from the E71 xDrive50i.

New M rims:

20" Decor silver II paint finish light alloy wheels V-spoke 299M with mixed tires (SA 2NT), are standard equipment.

Rocker Panels

The fully covered rocker panels are painted to match the exterior and have a black protective strip. The rockers have been adopted from the E70 (M Sport package). Running boards are not available.

E71 M

Front Fenders

The front fender is similar to that of the series production E71 with the addition of the recess for the side gill. The headlight washer system is fitted as standard equipment.



E71 M Side View

Wheel Arch Trim/wheel Arch Cover and Rims

The wheel arch trim at the front is identical to that on the E71 and painted to match the exterior. The wheel arch trim at the rear is considerably longer than the E71 and is also painted.

The front wheel arch cover and front brake air ducts are adopted from the E71 xDrive50i.

New M rims:

20" Slate Gray light alloy wheels double spoke 300M with mixed tires, burnished, paint-finished inner area (SA 2NU), are standard equipment.

Rocker Panels

The fully covered rocker panel is a new part and it is painted to match the exterior color. It does not have the black film as on the E70 M. Running boards are not available.

Rear Section

The four round exhaust tail pipes are a distinctive design feature on both models.

E70 M

The rear bumper cover with PDC is a two-piece unit similar to that in the E70 (M Sport Package). Quarter panels are taken from the E70 and the X5 M badge is displayed on the top right side of the deck lid.



E70 M rear view

E71 M

Except for the structured design trim, the upper bumper cover with PDC and the lower bumper cover are painted to match the exterior color. The X6 M badge is displayed on the top right side of the deck lid.



E71 M rear view

Underbody

The stiffening plate has cutouts to access the oil drain plug and oil filter. The engine compartment shielding is similar to that of E71. The M part is trimmed in the front area to accommodate the air duct for the additional inter-cooler heat exchanger, which is only fitted on the E70/E71 M. The brackets for the engine compartment shielding from the E71 are also fitted on both M vehicles.



E71 M, view of underbody stiffening plate

Particular attention was focused on the air flow around the drivetrain and the rear axle QMVH final drive unit, thus there is no underbody panel fitted. An aluminum air guide plate is installed to ensure optimum air flow around the aluminum transmission oil pan (series production vehicles use a plastic oil pan).

Right side view of underbody aluminum air guide



Heat Shields

New and adapted heat shields/thermal insulation:

- Three new heat shields per exhaust turbocharger.
- New heat shield for left-side engine mount and left-side engine support bracket.
- The thermal insulation for the rear silencer is a new part and identical for the E70 M and the E71 M.

Interior



E70/E71 M Passenger Compartment

With the “Nappa Leather Dashboard” option SA 4M5 the top surface is black new leather while the bottom is finished with Merino leather in the interior upholstery color, including the side window defroster panel (nappa black).

The center console knee pads integrated for the first time also in the E70 M and the side trim covers are finished in Merino leather.

Steering Wheel

M multifunction leather steering wheel with M shift paddles and M gearshift logic, (downshift on left, upshift on right). The M Mode/M Drive button replaces the freely programmable button. The M color stitching is a further distinguishing feature. The center trim with M logo is finished in black nappa leather. Steering wheel heating is optionally available.



Front Seats

M Sport Seats are fitted as standard.

These are fully electric sports seats with integrated side airbag and a seat belt buckle pretensioner. The seats are operated by means of a control switch on the seat. The control unit is also installed in the seat. Crash-active head restraints are installed as standard.

M seat features (driver and passenger) :

- Merino leather
- Seat heating
- Embossed M logo on head restraints
- Memory function for driver's seat

Possible seat options available:

ZAV Active ventilation seat package

- Comfort seats with lumbar support (456)
- Active seat for driver (451)
- Front seat ventilation (453)

Rear Seats

E70 M:

Full foam seat with backrest and seat cushion division and an upper body angle of 27°. The seat has a 60/40 division. The folding center armrest features a fixed, high-optimized headrest as well as a cup holder. The outer head restraints are manually adjustable.

Although the E70 third row seat option is not offered, rear seat heating is available as an option.

E71 M:

Full foam seat with backrest and seat cushion division and an upper body angle of 26°. The seat is divided at a ratio of 2/3 to 1/3.

The integrated head restraints and the individual seats with molded side sections underscore the high-performance coupe character of the rear seats. The special design layout of the headliner ensures optimum headroom without having to forego a folding center armrest and a ski bag (option). Optional seat heating is available on both models. (See ZCW Cold Weather Package)

Doors

The door trim panels are new in M design.

Door shoulder in nappa leather is included in option SA 4M5 leather-finish dashboard or the full Merino leather option. The full Merino leather option features complete door trim panel in leather.

M Specific Trim Strips

The following trim covers are offered for the E7x M:

- Aluminum Shadow trim strip in brushed aluminum. The brushed aluminum Shadow interior strips are fitted as standard exclusively on M vehicles.
- SA 4MY: Trim strip in black carbon structure leather. These interior trim strips in high grade nappa leather are optionally available exclusively for M vehicles.
- SA 4ML: Piano Finish Black Trim. The manufacturing process is intricate and requires great skill. They are offered by BMW Individual as optional extras also for the basic E7x.
- SA 4MU: Red Brown Grained Wood Trim. The hand-picked raw materials of the highest quality are put together individually for each vehicle. They are offered by BMW Individual as optional extras also for the basic E7x.

The interior trim finishers are located on the dashboard, center console, rear console (X6 M) as well as on the door trim panels.

Rocker Trim Panels, Footrest and Space-saver Spare Wheel

- Rocker panel strips with M logo
- M footrest (only LHD)
- The compartment for the “optional” aluminum space-saver wheel (SA300) is new due to its size of 19". The jack and wheel wrench holders are integrated in the compartment.

E70 M Adaptations

The E70 M has a new adapter and bracket in the luggage compartment for the ICM control unit (also used in E71 M).

The battery cover has a new geometry to accommodate the QMVH control unit. The battery cover has an integrated storage compartment and no battery access. This compartment accommodates the vehicle toolkit and the handle for the emergency release of the electromechanical parking brake.

Powertrain

"M TwinPower Turbocharged Engine" S63B44O0



Technical data of the S63 engine in comparison with the N63 engine

Description	Unit	S63B44O0	N63B44O0
Type/valves per cylinder		V8/4	V8/4
Engine management		MSD85.1	MSD85
Distance between cylinders	[mm]	98	98
Displacement	[cm ³]	4395	4395
Firing order		1-5-4-8-6-3-7-2	1-5-4-8-6-3-7-2
Stroke/bore	[mm]	88.3/89	88.3/89
Power output at engine speed	(kW) bhp [rpm]	(414) 555 5750-6250	(300) 400 5500-6400

Description	Unit	S63B4400	N63B4400
Power output per liter	(kW/ltr) bhp/ltr	(92.8) 126.3	(68.3) 92.8
Torque at engine speed	(Nm) ft lbs [rpm]	(680) 500 1500-5650	(600) 450 1750-4500
Cut-off speed	[rpm]	6800	6500
Compression ratio	–	9.3	10.0
Fuel injection principle/ Turbocharging	–	Direct homogeneous / Twin scroll Twin-turbo	Direct homogeneous/ Twin-turbo
Maximum boost pressure (excess pressure)	[bar]	1.2	0.8
Intake valve Ø	[mm]	33.2	33.2
Exhaust valve (sodium-filled) Ø	[mm]	29.0	29.0
Intake: Valve timing duration/spread Valve lift: Intake VANOS adjustment angle	[°cr/°cr] [mm] [° cr]	231/70-120 8.8 50	231/70-120 8.8 50
Exhaust: Valve timing duration/spread Cylinders 1, 3, 5 and 6 Cylinders 2, 4, 7 and 8 Valve lift: Exhaust VANOS adjustment angle	[°cr/°cr] [°cr/°cr] [mm] [° cr]	252/73.5–123.5 252/73.5–123.5 9.0 50	231/70-120 215/64-114 8.8 50
Crankshaft main bearing journal Ø	[mm]	65.0	65.0
Crankshaft big-end bearing journal Ø	[mm]	54.0	54.0
Fuel compatibility	[RON]	91–98	91–98
CO2 emission	g/km	325	299
Exhaust emissions standard US	–	LEVII	LEVII



E70/E71 M - S63 engine

Crankcase, Cylinder Head and Valve Timing Components

The crankcase was taken from the N63.

In view of the high ignition pressures of the S63, the pistons were upgraded accordingly.

The interior structure of the crankcase ventilation system has been adapted in terms of the oil separator and control valve (similar to S85).

Cylinder Head

The cylinder head has been adapted to accommodate the higher thermal and mechanical loads, the modified turbochargers (ATL) and exhaust manifold as well as the increased transverse dynamics of the vehicle.

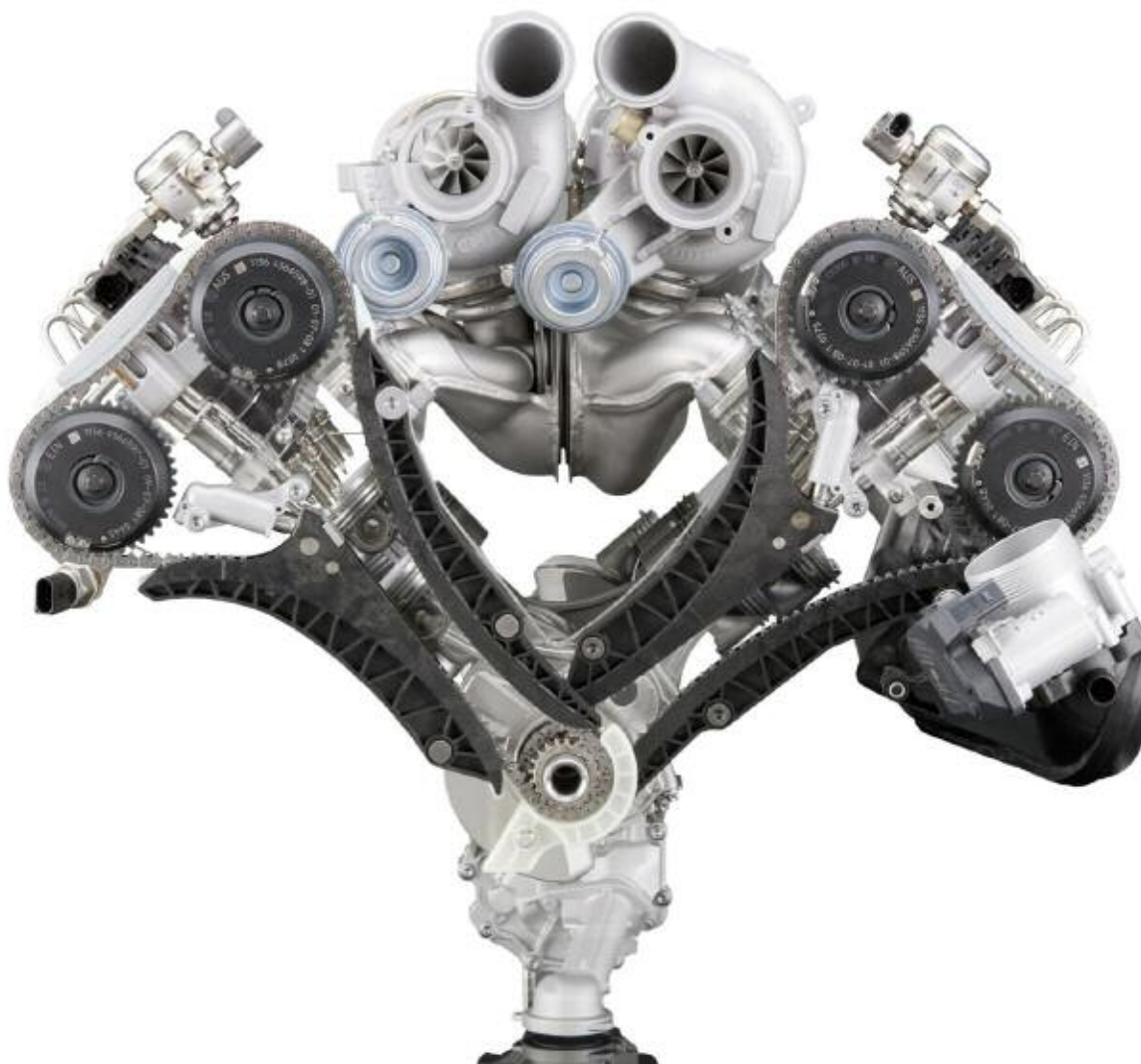
The following changes have been made to the cylinder heads compared to the N63:

- The S63 cylinder heads are made from a higher grade alloy
- Adapted bolt pattern arrangement for the new exhaust manifold
- The exhaust camshafts are new and specific to the S63

Other changes to the top of the engine include the newly designed oil filler neck and its new location as well as the redesigned thermostat housing.

Note: It is important to note that the rigidity of the engine mounts on the S63 has been adapted to M specific requirements.

Timing Components



E70/E71 M timing gear

The timing components have been adopted from the N63 engine.

The following changes have been made:

- The cam timing has been adapted accordingly (see Technical Data)
- The exhaust camshafts are new components, specific to the S63.

Exhaust System

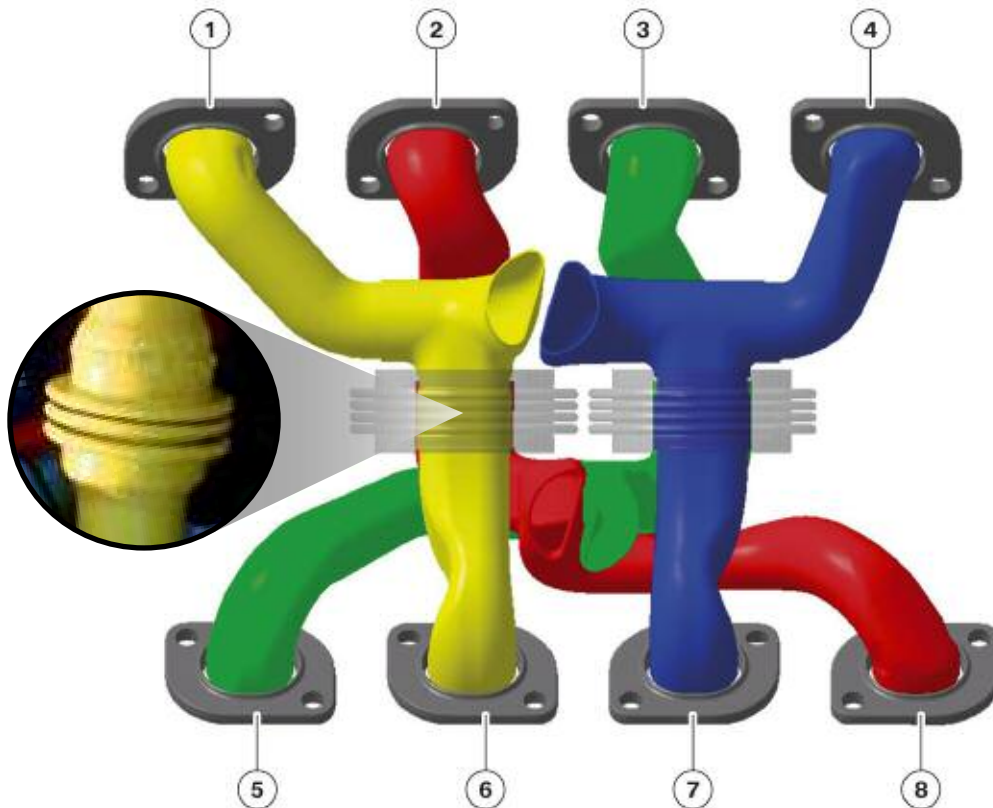
Exhaust Manifold

On the N63, a single-flow, cast exhaust manifold per cylinder bank is assigned to each exhaust turbocharger (cyl. 1–4 and cyl. 5–8).

The S63 is fitted with a four-flow, air gap insulated tuned pulse exhaust manifold that connects both cylinder banks. In an ideal configuration, the exhaust gas pulses from cylinders 1/6 and 4/7 are fed to the turbocharger installed over the right bank (cyl. 1-4) and the exhaust gas pulses from cylinders 2/8 and 3/5 are fed to the turbocharger installed over the left bank (cyl. 5-8).

This design creates a spacing of 360° of crankshaft angle between the two exhaust cycles within the exhaust flute that feeds each twin scroll turbocharger turbine. The effective utilization of the exhaust gas energy delivers optimum de-throttling, ideal response characteristics and minimizes turbo lag.

Corrugated pipes combined with sliding seat flanges connect the exhaust ports from both banks within the center of the manifold outer shell to compensate for thermo-mechanical expansion and contraction. (See below)



E70/E71 M tuned pulse exhaust manifold sequence explained

The specially designed exhaust manifold connects each of the 8 cylinders in sequence according to the exhaust pulses in the firing order. This delivers a uniform flow of exhaust gas to the turbochargers which improves volumetric efficiency by promoting cylinder scavenging.

Every 180° of crankshaft rotation, one exhaust gas pulse is fed to each turbocharger over the entire ignition sequence (1–5–4–8–6–3–7–2).

This highly efficient charging concept achieves optimum energy transmission of the exhaust flow to the turbine blades of the turbochargers. The result is the fastest and most direct response characteristics of any turbo engine worldwide. The innovative technology is patented by BMW and therefore represents a unique selling point over the competition.



Cut away view of E70/E71 M exhaust manifold and twin scroll turbo.

Advantages of the Twin-scroll Turbo System

The response characteristics of the exhaust turbochargers are enhanced when compared to the N63. The S63 turbocharger turbines are fed through two separate channels within the turbine housing (highlighted red in the graphic above). Each of these channels or “scrolls” is always fed by the exhaust pulses from the same two cylinders.

The layout and cross sections of the turbine impeller and compressor wheels have been correspondingly adapted and are designed for the maximum exhaust inlet operating temperature of 1020° C (1868° F).

The diverter valves are now integrated in the charge air line and have a hose connection to the turbocharger compressor inlet side (See the graphic on the next page).

Catalytic converters and oxygen sensors are the same as in the N63 with the cable routing of the oxygen sensors adapted accordingly to the new engine.

S63 exhaust turbocharger assembly showing new diverter valve location



Overview/comparison of the exhaust system "Hot End" of S63 with N63

Description	Unit	S63B4400	N63B4400
Exhaust manifold		Connects both cylinder banks and uses twin-scroll technology	One manifold per cylinder bank, single-flow
Turbocharger		Twin scroll, Twin turbocharger	Twin turbocharger
Maximum exhaust temperature Exhaust turbocharger inlet	[° C]	1020	950
Exhaust catalytic converter x 2	[ltr]	3.6	3.6
Oxygen sensors		LSU ADV sensor before catalytic converter LSF 4.2 sensor after catalytic converter	

Exhaust Components After Catalytic Converter "Cold End"

The exhaust system downstream of the catalytic converter in the E7x M is based on the exhaust system of the E71 xDrive 50i and adapted to the requirements of the S63 engine.

Particular attention was paid to ensuring optimum pipe layout routing using the largest possible pipe diameter.

The four M tail pipes with chrome tips round off the dynamic and sporty appearance of the vehicles.

E70/E71 M exhaust system downstream of the catalytic converter



Overview/comparison "Cold End" exhaust system

Description	Unit	E70/E71 M (S63)	E71 xDrive50i (N63)
Ø front pipe, left/right	[mm]	80/80	70/80
Center silencer (volume) x 2	[ltr]	4	5
Ø intermediate pipes	[mm]	75	27
Rear silencer (volume)	[ltr]	36	27
Number of tailpipes x Ø pipe x exhaust flap; Shape/number of chrome outlet tips	[mm]	4 x Ø 60mm x 2 flaps; 4 round tips	4 x Ø 60mm x 2 flaps; 2 oval tips

Air Intake System

Intake Silencer (AGD)

To enhance air flow to the engine while taking pedestrian protection into consideration, the intake silencer has been redesigned and fixed to the body directly in front of the engine (on N63 its fixed to the engine).

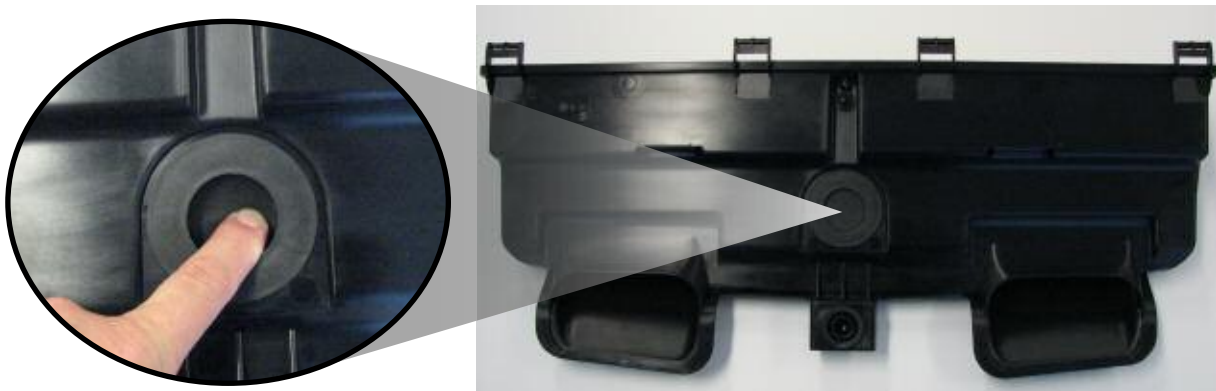
Two activated carbon filters prevent pollutants (that could stem from the engine) from entering the intake system when the engine is not in operation, complying with corresponding emission requirements.

US models use an intake silencer with an integrated snow valve and additional activated carbon filter mesh.



Snow Valve

The snow valve is a filter bypass valve that is opened by engine vacuum. It allows continued engine operation (at greatly reduced power output) if necessary, should the air cleaner be iced up or closed off with packed snow in extreme weather conditions.



Vacuum Supply

The vacuum pump has been adopted from the N63. The two plastic vacuum accumulators each with a volume of 0.3 l are new and are located under the engine cover (N63 uses one accumulator designed as a metal cylinder under the turbochargers).

Cooling Systems

As in the series production X6 (xDrive50i) the X5/X6 M have two cooling systems, the main engine cooling system and a low temperature cooling system dedicated to intake charge air cooling (turbo intercooling).

The following components have been adopted from the N63 and are common with series production E71 vehicles:

- The low temperature system heat exchanger for the intercoolers
- Air conditioning condenser
- Power steering oil cooler
- The standalone auxiliary radiator

The expansion tank for the main engine cooling system was taken from the E70.

New and Adapted Cooling Components

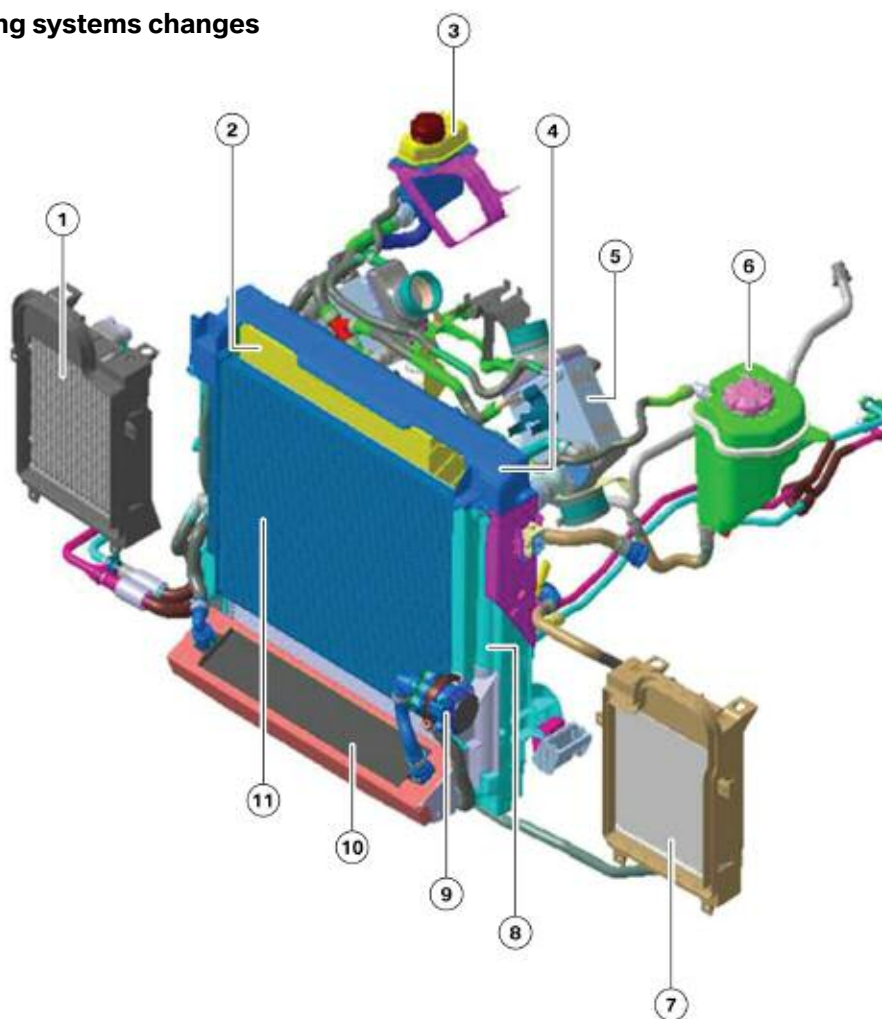
The main coolant radiator takes up the same package space as in the E71 but has a winglet tubing design, for increased surface area. It no longer contains the integrated low temperature area for the transmission oil-to-coolant heat exchanger.

The engine oil cooler has been adapted to the higher engine output by increasing the core depth from 30 mm to 45 mm.

The charge air (low temperature) cooling system has an additional intercooler heat exchanger installed in series, a second auxiliary water pump and a new expansion tank. The length of the engine intercoolers (LLK) has been increased from 130 mm to 160 mm. The measuring range of the boost pressure sensors at the intercooler outlet has also increased to 4 bar.

The transmission oil heat exchanger has been adapted to the higher engine output by increasing the number of plates from 23 to 31.

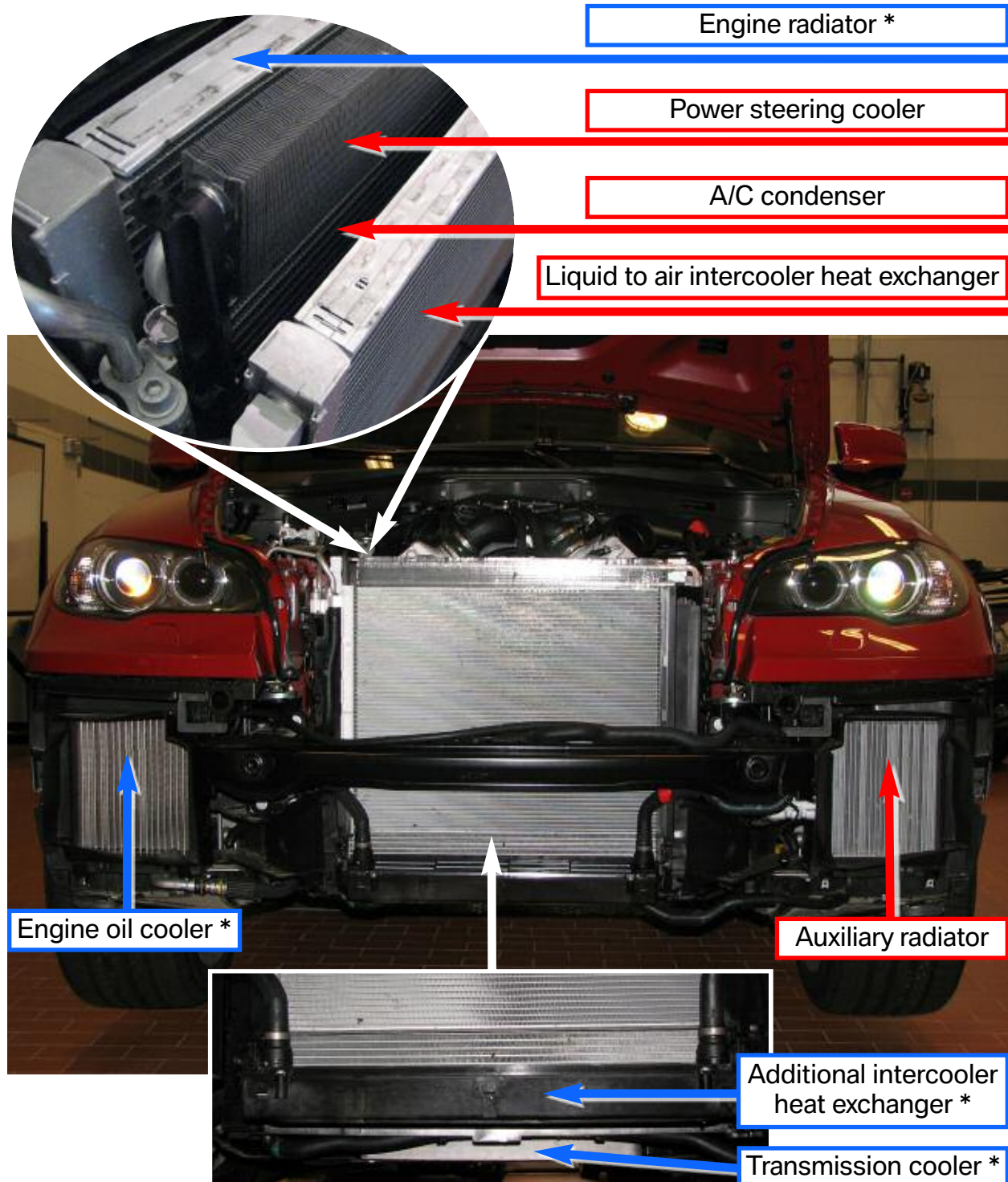
E70/E71 M cooling systems changes



Index	Explanation
1	Adapted: Engine oil cooler, 45 mm deep (N63: 30 mm deep)
2	Power steering cooler
3	New: Low temperature cooling system expansion tank and location
4	Adapted: Engine radiator with winglet tubing design w/o transmission cooler section
5	Adapted: Air to coolant intercoolers, 160 mm long (N63: 130 mm long)
6	Engine cooling system expansion tank
7	Auxiliary radiator
8	Air conditioning condenser
9	New: Second auxiliary water pump for the low temperature cooling system
10	New: Additional intercooler heat exchanger (low temperature cooling system)
11	Intercooler heat exchanger (low temperature cooling system)

Cooling Module Components

The components highlighted in “blue” (*) below are new or have been newly designed to meet the specific requirements of the M powertrain. The components highlighted in “red” are carried over from the series production E71 xDrive50i model.



Transmission

With the M Sport automatic transmission 6HP26S the customer is able to enjoy spontaneous gearshifts and a more stable control of the torque converter lock-up clutch.

To effectively absorb rotational irregularities in the drive train and achieve the best possible reduction of the slip at the converter lock-up clutch, a double-damper torque converter is installed. A single-damper torque converter design is used in the 6HP26TU of the E71 xDrive50i.

The spring characteristics in the double-damper converter are especially designed for the increased power and torque of the S63 engine. The 6HP26S internal components have also been adapted to the maximum engine speed of 6800 rpm.

The plastic transmission oil pan has been replaced with an aluminum version. The air flow to the transmission has been enhanced and the opening point of the transmission oil thermostat has been lowered.

The gear ratio is identical to that of the series production 6HP26TU transmission.



E70/E71 M aluminum transmission oil pan

Shift range	Gear ratio [:1]
1st gear	4.171
2nd gear	2.340
3rd gear	1.521
4nd gear	1.143
5nd gear	0.867
6nd gear	0.691
Reverse gear	3.403

M Gear Selector Lever (M GWS)

The functional design of the M gear selector lever is similar to the series production E7x. A new feature of the design is the integrated M logo in the gear indicator of the M gear selector lever.

The button for the electronic damper control (standard equipment feature) is positioned on the base of the gear selector lever.



E70/E71 M gear selector lever

Transmission Control

The electronic transmission control unit (EGS) for the 6HP26S, is integrated into the transmission case as on the series production model.

The transmission control software is adapted to M specific requirements.

The transmission now features even shorter shift times in manual mode, ensured by a new type of torque reduction system involving cylinder cutout. This feature along with the short axle transmission ratio emphasize the sporty characteristics of the vehicle.

A special M shifting program ensures quick and precise gear changes and enhances throttle response throughout the three driving modes.

Shift times and accelerator pedal characteristics can be adapted to the driver's preference and driving situation:

Dynamic driving program		Gearshift program	
Efficient	D XE Shift time: Comfort Accelerator Pedal: Normal	DS S Shift time: Sport Accelerator pedal: Normal	M M Shift time: Sport+ Accelerator Pedal: Normal
Sport	XE Shift time: Comfort Accelerator Pedal: Sport	S Shift time: Sport Accelerator Pedal: Sport	M Shift time: Sport+ Accelerator Pedal: Sport+
	"Flick in D" with paddles: Temporary manual mode M, automatic return to D depending on parameters	"Flick in DS" w/ paddles: Branch to permanent manual mode M	No forced upshift; no down shift via kick-down; 1st gear is selected automatically when stopping and starting off
XE = extreme fuel economy shift program, S = sports shift program, M = manual shift program Sport = fast shift speed and sports accelerator pedal characteristic, Sport+ = very fast shift speed and very sporty accelerator pedal characteristic.			

Note : The weight of the transmission has increased slightly as the result of the converter technology used.

■ Launch Control

Launch control ensures optimum vehicle acceleration when starting on a road surface with sufficient grip.

Activation is not possible if one of the preconditioning requirements is not met and if the transmission oil temperature is too high. (See Owner's Manual)

The alternator power output is reduced to zero when launch control is activated, in order to further optimize power. However the A/C compressor remains active to address possible window fogging.

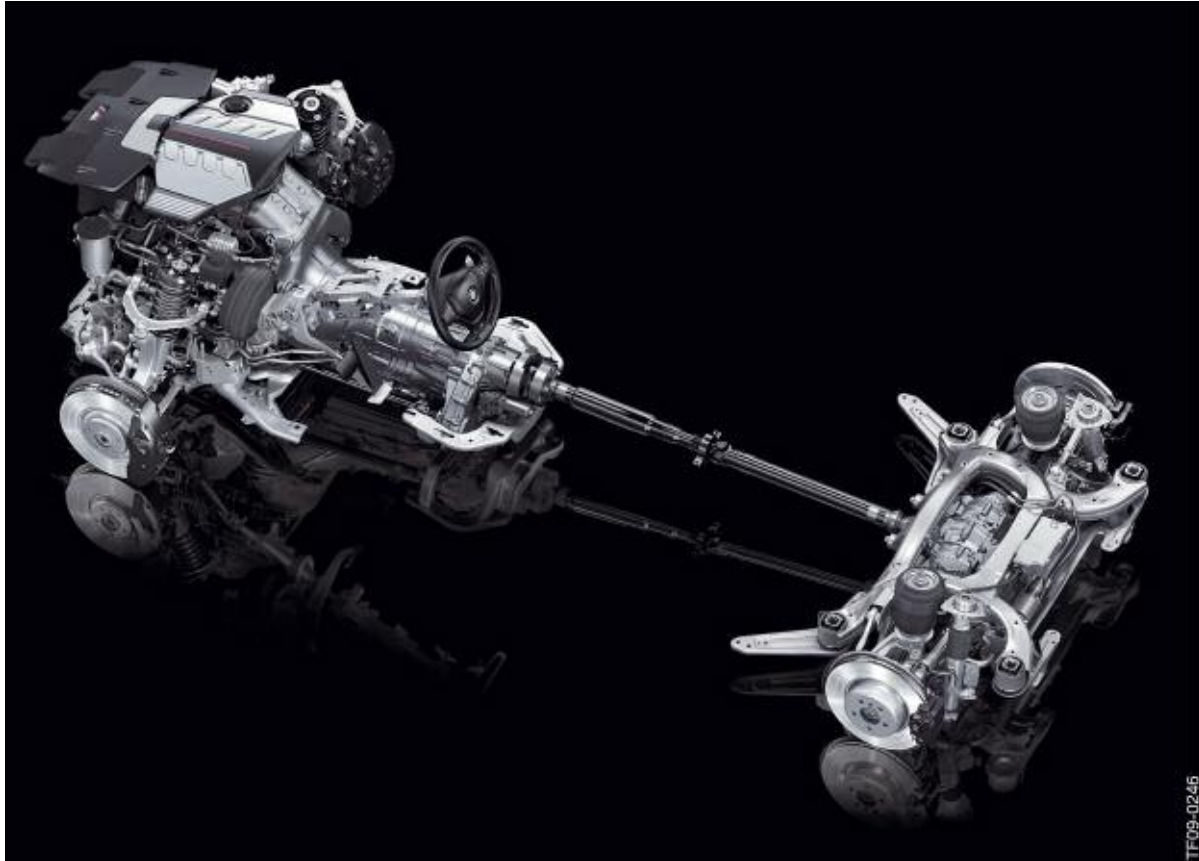
Note: For further information regarding E70/E71 M Launch Control refer to the vehicle Owner's Manual.

Transfer Case and Final Drive

The xDrive transfer case and input/output shaft have been adopted from the series production models. The rigidity of the rubber mounts in the transmission mounting has been adapted to the application.

Chassis and Suspension

The vehicle is 10mm lower with stiffer suspension settings and M specific rear air springs. The damper setup was especially adapted to the increased structural stiffness of the chassis.



E7x M complete chassis and suspension structure

Front Axle

Springs and Struts

Front springs are series production E71 with EDC. Shock absorbers are also E71 N63 with EDC but with piston rods adapted to the newly designed strut mounts. Damper hardness and characteristic were specially adapted to M requirements and suspension setup.

Links, Struts and Wheel Bearing Assemblies

The rigidity of the upper control arm has been enhanced as well as the wheel bearing assembly with the use of a reinforced outer bearing race.

Steering

The M rack and pinion power steering is equipped as standard with Servotronic. It has an overall steering ratio of 19.5:1 and 3.11 turns from lock to lock is equal to the standard E7x series production vehicle.

The power steering pump of the E70 M is equipped with the proportional valve for electronic volumetric flow adjustment (EVV valve). The EVV valve and the Servotronic valve are controlled directly by the ICM control unit.

Note: The oil pressure in the power steering system is minimized corresponding to the situation (e.g. driving straight ahead) by means of the EVV valve. This feature is already known from the E71 and F01 as part of CO2 reduction measures.

Rear Axle

The rubber mounts between the body and rear axle carrier are adapted in terms of their rigidity to M specific requirements.

Springs and Struts

New strut mounts with specially adapted internal rubber section are installed. The air springs are new and have been adapted to the strut mount, lower vehicle height and M specific tuning. The air springs are based on the E71 N63 EDC but with layout for M suspension setup. The shock absorbers are also based on the E71 N63 EDC, with the piston rod adapted to the new strut mount. Damper hardness and characteristic were especially adapted to M requirements.

Links, Struts and Wheel Bearing Assemblies

The rigidity of the pivot link, control arm and trailing arm has been correspondingly enhanced. All links and wheel bearings have been adopted from the series production E71.

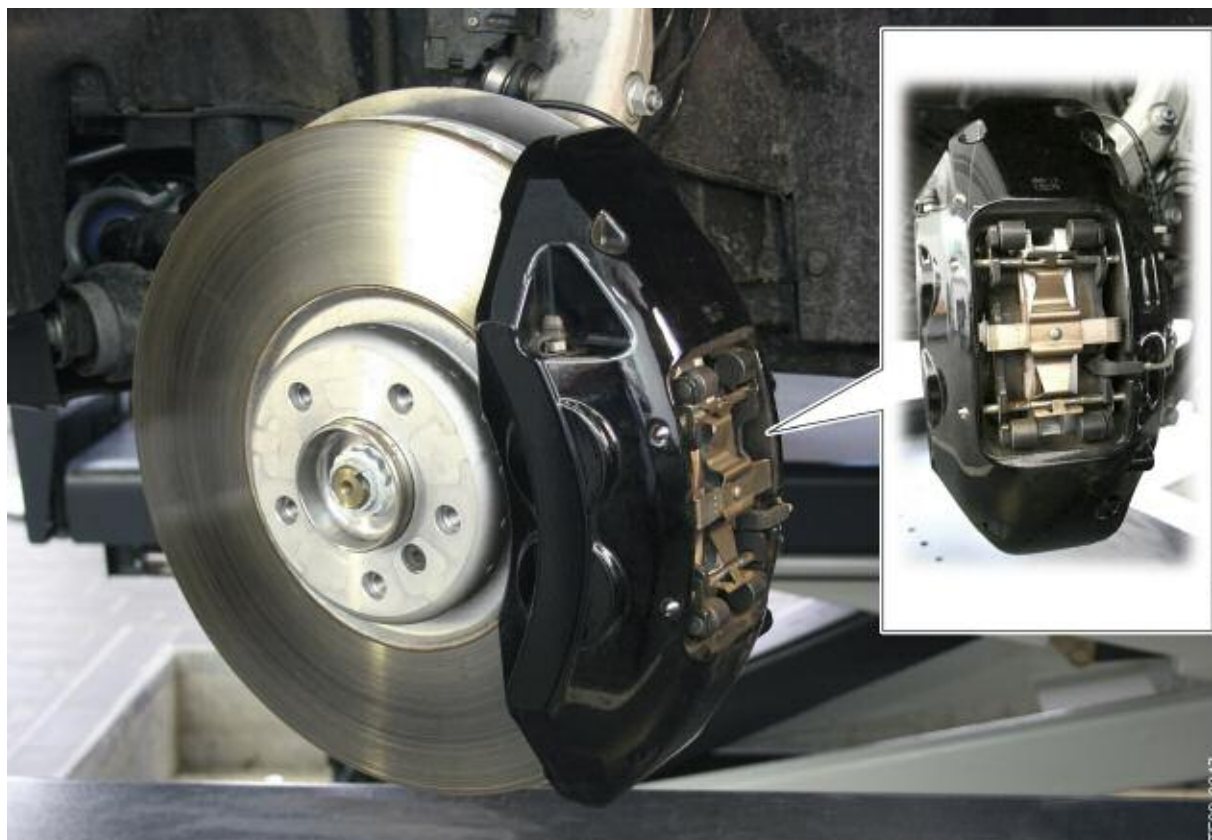
Brakes

The brake master cylinder has undergone slight modification to enable even sportier response. The front and rear brakes have been enlarged compared to the current series production X5 and X6.

Directional (Ø 395 mm/15.56") lightweight brake rotors are fitted in the front (Geomet®-coated cast iron friction surface on aluminum center hubs) with new four piston aluminum mono block fixed callipers, painted black. The brake guard plates on the front axle have been adapted to the larger brakes.

The rear brakes rotors are of the same design as the front (cast iron with aluminum center hubs). They are Ø 385 x 24mm/15.2 x 0.9" and use floating calipers adopted from the X6 xDrive50i.

Note: The Geomet® coating of the rotors provides corrosion protection.



E70/E71 M front wheel brake

Brake overview

Description	E70 M	E71 M	E71 xDrive50i
Front brake rotors	Ø 395 x 36mm (15.6 x 1.4 inch)	Ø 395 x 36mm (15.6 x 1.4 inch)	Ø 365 x 36mm (14.4 x 1.4 inch)
Front brake caliper	Brembo M4.42 aluminum 4-piston mono block fixed caliper (painted black)		Floating caliper, single piston
Rear brake rotors	Ø 385 x 24mm (15.2 x 0.9 inch)	Ø 385 x 24mm (15.2 x 0.9 inch)	Ø 345 x 24 mm (13.6 x 0.9 inch)
Rear brake calipers	Floating caliper adopted from current E71 xDrive50i (painted black)		Floating caliper, single piston

Wheels and Tires

Although both vehicles use 20" rims with run-flat mixed tires, we have different rim styling for E70 M and E71 M.

E70/E71 M wheels



Overview of wheels and tires:

Description	E70 M / E71 M		E71 xDrive50 i
General note on summer tires	Run flat RSC; weight index XL speed index; US: W		
Rim styling	V-spoke 299M	Double spoke 300M	
Front Axle: Tire Rim hub Ø 74mm	275/40 R20 10J x 20 EH2+ IS40		255/50 R19 9J x19 EH2+IS48
Rear axle: Tire Rim hub Ø 72.5mm (also E70M)	315/35 R20 11J x 20 EH2+ IS35		255/50 R19 9J x19 EH2+IS18
Winter wheel	Styling: V-spoke 298M (SA:9WR); 255/50 R19 107V XL (RSC;M+S); 9Jx19 EH2+ IS 37/18; hub Ø 74/72.5mm		
SA Space-saver wheel	LM155/80R19; 5J x 19H2IS4; hub Ø 74mm		

Dynamic Driving Systems

With the E70/E71 M, the handling characteristics of M vehicles are introduced for the first time to the High Performance Sports Activity Vehicle/Sports Activity Coupe class.

Vehicle dynamics management (VDC and Dynamic Drive) and Integrated Chassis Management (Dynamic Performance Control and Servotronic) are installed as standard.

This makes the E70 M the first BMW X5 with Integrated Chassis Management and Dynamic Performance Control.

Although Active Steering is not offered, both vehicles feature M rack and pinion power steering systems with Servotronic.

The M specific driving dynamics (longitudinal, transverse and vertical) were tuned on the North loop of the Nürburgring race track with the main focus on handling and lap times.

Vertical Dynamics Management

Vertical dynamics control (VDC) and active roll stabilization (ARS) have been functionally combined to create vertical dynamics management. This was first introduced in the E70 with the marketing designation Adaptive Drive.

The VDC function integrated in the vertical dynamics management control unit (VDM) controls the adjustable dampers. As an expansion to the EDC-K system, the transverse acceleration is now included as an input signal together with the ride height, longitudinal and vertical acceleration. The VDM control unit coordinates the functions between the VDC and ARS, i.e. between damper and stabilizer bar control.

As a CO₂ reduction measure when driving in a straight line, the fluid flow rate of the ARS radial piston pump is restricted by the intake restrictor valve on the intake side of the circuit, thereby substantially reducing the circulation pressure and, therefore, the engine power used to drive the pump. The VDM operates the intake restrictor valve lowering ARS system pressure when ARS is not needed.

Adaptive Drive is installed as standard in the E70 M and E71 M. The integration of these systems in connection with M specific tuning ensures a maximum in terms of dynamics, comfort and safety in this vehicle class. The agility of the vehicle has been optimized while taking long distance driving suitability into consideration.

Vehicle handling can be enhanced for dynamic driving with the EDC button on the gear selector lever and the DSC button on the center console. Both button functions can also be preconfigured in the M Drive menu and selected by means of the M button on the steering wheel.

EDC Button Selection Option

The EDC on the current M3, M5 and M6 models has three selection options "Comfort", "Normal" and "Sport" where no dynamic control takes place in the "Sport" selection but rather only the dampers are set extremely hard (ideal for slalom).

E70 M and E71 M feature two selection options, "Normal" and "Sport", where dynamic control also takes place in "Sport".

■ EDC Normal

Although the E70/E71 M offer a distinct increase in driving dynamics compared to the respective series production model. EDC and Servotronic have normal characteristics in this setting. This mode offers a balanced setup that combines M characteristic dynamic driving potential with comfort.

■ EDC Sport

In this mode, the suspension offers the maximum suspension stiffness and higher steering torque to deliver even greater dynamic driving performance. A sportier Servotronic characteristic ensures optimum steering feedback.

Transverse Dynamics Management

The Integrated Chassis Management (ICM) represents the system network for controlling transverse dynamics.

This control unit coordinates the interaction between Servotronic, Dynamic Performance Control and DSC.

Dynamic Performance Control

The function of the torque vectoring final drive unit (Dynamic Performance Control) was first introduced in the E71 and is coordinated by the ICM control unit while the actuators of the Dynamic Performance Control are controlled by the QMVH (transverse torque distribution control unit for the rear axle).



The main differences of the E70/ E71 M compared to the series production E71 include the adaptation of the dynamic driving parameters as well as additional cooling measures.

The Dynamic Performance Control function can now be displayed on the CID. The current drive torque distribution applied by the Dynamic Performance Control and xDrive is approximately represented by arrows at all four wheels. (See graphic)

M specific conventional rack and pinion steering gear with Servotronic is fitted on the E70/E71M. The Servotronic valve is controlled by the ICM. Active Steering is not available on either of these vehicles.

Longitudinal Dynamics Management

Longitudinal dynamics management is a feature of the Dynamic Stability Control (DSC). By sending information to the transfer case control unit (VTG), the DSC controls the power distribution between the front and rear axles. Based on information sent to the ICM, the transverse torque distribution at the rear axle is additionally influenced under unstable vehicle conditions.

The xDrive all-wheel drive system provides permanently variable torque distribution between the front and rear axle.

To increase driving dynamics, on the E70/E71 M more torque has been sent to the rear wheels. The transferred drive torque to the front axle is less and distinctly delayed when compared to the E70 and E71, especially in M Dynamic and DSC OFF mode.

The understeer tendency of the all-wheel drive is greatly reduced especially while driving out of corners. This means that power can be applied earlier and higher speeds can be achieved.

M Dynamic Mode (MDM) and DSC OFF Mode

In M Dynamic mode (MDM), the typical self-steering M vehicle characteristic response is achieved by:

- the extended control thresholds for brake intervention,
- the distinctly later engine power reduction by ASC and
- the rear end emphasized xDrive setup together with Dynamic Performance Control.

Even at full power at the apex of a bend, the E70 M and E71 M follow the steering line and the vehicles can be steered with the accelerator pedal.

Maximum cornering speeds can be achieved in active MDM mode while retaining driving safety. The setup of the xDrive and Dynamic Performance Control is correspondingly adapted in this mode. Brake interventions only take place in extreme driving situations in connection with high transverse acceleration. Engine power output is not reduced as the result of wheel slip.

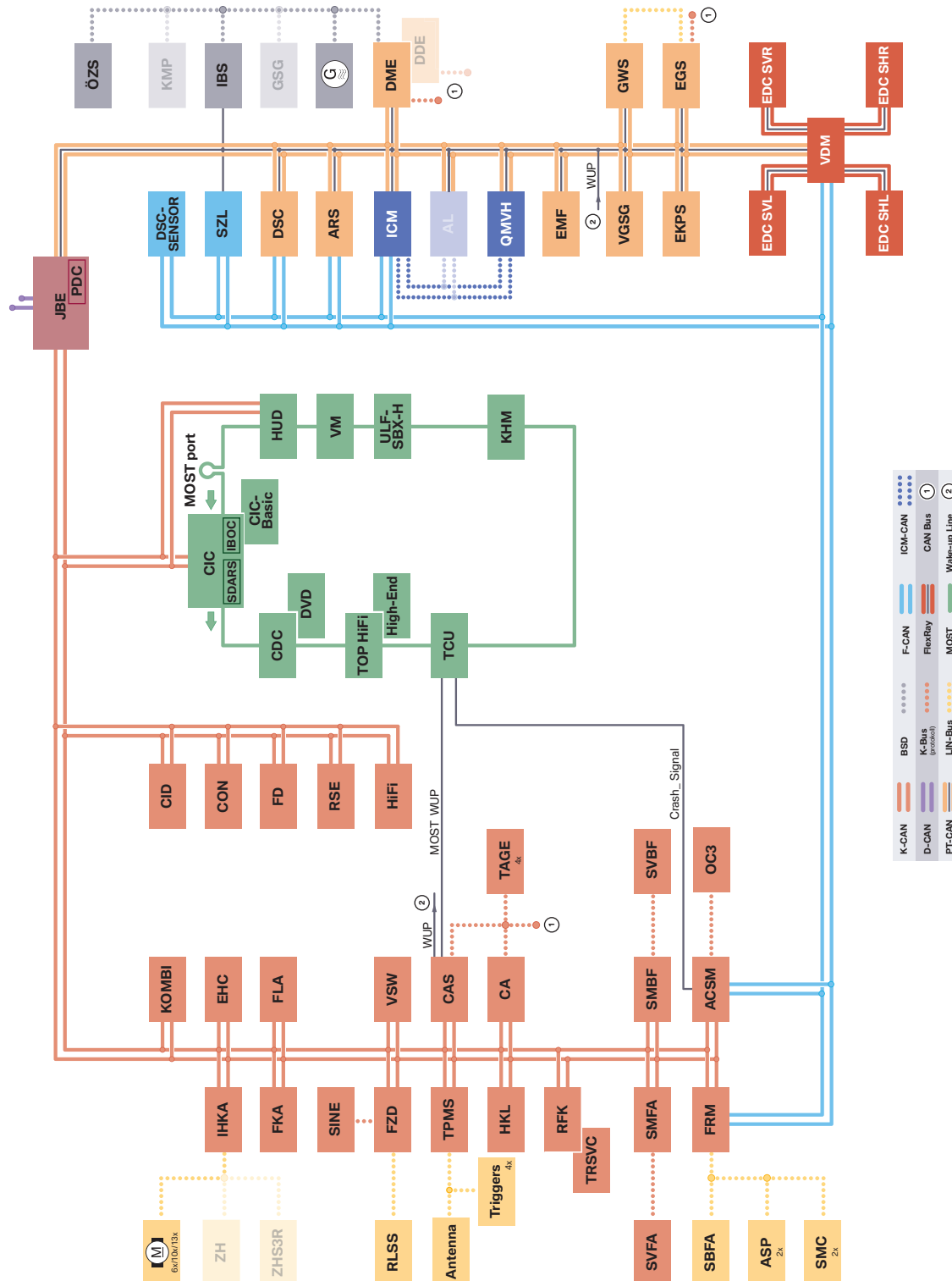
It is possible to change between DSC ON, MDM and DSC OFF by means of the DSC button or the configuration in the M Drive menu.

With DSC OFF a check control message will be displayed on the instrument panel and on the HUD. In this case MDM and DSC are simultaneously deactivated thus the stabilizing interventions are now **not** carried out. (See Vehicle Owner's Manual for more information.)

CAUTION!!! To maintain vehicle stability drive with DSC switched ON and M Dynamic Mode switched OFF whenever possible.

Vehicle Electrical System

E70/E71 M Bus System Overview



Index	Explanation
ACSM	Advanced crash safety module
AL	Active steering (not installed)
HIFI	High fidelity amplifier
TOP HIFI	Top high fidelity amplifier *Top-HiFi system
ARS	Active roll stabilization (Dynamic Drive)
ASP	Exterior mirror
CA	Comfort access
CAS	Car access system
CDC	CD changer
CIC	Car information computer
CIC Basic	Basic Car information computer (No Navigation and smaller CID)
CID	Central information display
CON	Controller
DDE	Digital diesel electronics (not installed)
DME	Digital engine electronics
DSC	Dynamic stability control
DSC-Sensor*	Dynamic stability control sensor *DSC-SEN
DVD	DVD changer
EDC SHL	Electronic damper control, rear left satellite
EDC SHR	Electronic damper control, rear right satellite
EDC SVL	Electronic damper control, front left satellite
EDC SVR	Electronic damper control, front right satellite
EGS	Electronic transmission control unit
EHC	Electronic ride-height control
EKPS*	Electronic fuel pump control *EKP
EMF	Electromechanical parking brake
FD	Rear compartment display
FKA	Rear automatic climate control
FLA	High beam assistant
FRM	Footwell module
FZD	Roof functions center

Index	Explanation
GSG	Pre-heater control unit (only on diesel models)
GWS	Gear selector lever
High-End	BMW Individual High End audio system
HUD	Head-up display
IBS	Intelligent battery sensor
ICM	Integrated chassis management (also on E70 M)
IHKA	Automatic climate control
JBE	Junction box electronics (with integrated PDC)
KHM	Headphones module
KMP*	Electric coolant pump (not installed) *EWP
KOMBI	M Instrument cluster
PDC	Park distance control (now integrated in junction box electronics)
ÖZS*	Oil condition sensor *QLT
QMVH	Transverse torque distribution, rear axle (dynamic performance control also E70 M)
TPMS	Tire pressure monitoring system
TPMS-Sender*	Tire pressure monitoring sender
RFK	Reversing camera
RLSS	Rain/drivinglights/solar sensor
RSE	Rear seat entertainment (rear compartment entertainment)
SBFA	Driver's switch cluster
ULF-SBX-H*	Interface box High (USB/audio interface) *SBX-High
SBE*	Seat occupancy pad *OC3
SINE	Siren with tilt alarm sensor
SMBF	Passenger's seat module
SMC	Stepper motor controller
SMFA	Driver's seat module
SVBF	Passenger's seat adjustment
SVFA	Driver's seat adjustment
SZL	Steering column switch cluster
TAGE	Electronic outer door handle module

Index	Explanation
TCU	Telematics control unit
TRSVc	Control unit for rear view, side view and top view camera
VDM	Vertical dynamics management
VM	Video module
VSW	Video switch
VTG*	Transfer case control unit *VGSG
ZH	Auxiliary electrical heater (only on diesel models)
ZHS3R*	Auxiliary heating control, 3rd row of seats (not available on E70 M) *HB3SR
1	CAS bus connection
2	PT-CAN Wake-up line
BSD	Bit-serial data interface
D-CAN	Diagnosis on controller area network bus system
F-CAN	Chassis controller area network bus system
FlexRay	FlexRay bus system
ICM-CAN	Integrated chassis management controller area network bus system
K-Bus	Body bus (protocol)
K-CAN	Body-controller area network bus system
LIN	Local interconnect network bus system
Local-CAN	Local controller area network bus system
MOST	Media oriented system transport bus
MOST port*	Media oriented system transport bus direct access *FS
PT-CAN	Powertrain controller area network bus system
WUP	Wake-up line
[*]	Abbreviations marked with * had to be adapted to the M model. (The function, installation location and hardware are not affected).

The following differences between the electrical systems of the series production E7x vehicles compared to the E70/E71 M must be noted:

PT-CAN:

The S63 is exclusively equipped with the DME MSD85.1.

The control unit for active steering (AL) has been dropped as active steering is not offered for the E70/E71 M vehicles. However all other control units (DSC, ICM, QMVH, VDM and ARS) are installed because E70 M and E71 M are equipped with Adaptive Drive, Dynamic Performance Control and Integrated Electronic Height Control as standard equipment.

K-CAN:

The PDC function has been integrated in the junction box as on F01.

The control unit for the optional auxiliary heating control for the 3rd row of seats (ZHS3R) has been dropped as this option is not offered for the E70 M.

TRSVc top rear side view camera (option) is installed for the first time on US E7x vehicles

MOST:

As from 10/09 the CIC is also installed in the series production E70 and E71 vehicles and there is no difference in the vehicle electrical system of the E70/E71 M vehicles compared to the series production E71 models.

CIC Basic uses a smaller screen and refers to the CIC option without Navigation

The functions of the CCC/MASK/CHAMP, IBOC, SDARS are all integrated in the CIC. These control units are therefore no longer installed in the vehicle.

Instrument Cluster



E70/E71 M instrument cluster

Index	Explanation	Index	Explanation
1	M characteristic pointers	7	M logo
2	Permanent lighting of dial in white as from terminal 15	8	Moving-disc instrument for rev counter with variable advance warning zone (for engine warm-up) and warning zone
3	Speedometer up to 300 km/h/186mph	9	Rev counter up to 8000 rpm
4	M characteristic "Lights On" lamp	10	Oil temperature gauge instead of economy gauge
5	M Dynamic Mode lamp	11	POWER shown when the sport characteristic of the drive is set
6	M Drive lamp on activation of M button on steering wheel	12	Display of gearshift ranges same as M5 (D, S and manual mode with gear indicator)

M Head-up Display

The head-up display can be change to the M display.



M specific head -up display

The display/indicators of the M HUD is the same as in M5/M6:

- Rev counter band
- Shift lights function
- Gearshift range (gear)
- Vehicle speed

Activation of the M HUD is also the same as on M5/M6.

After configuration in the M Drive menu, activation of the M HUD is done by pushing the M button on the steering wheel or by means of a selection in the HUD-up configuration menu.

M Drive Menu

The M Drive menu can be found under the Settings menu. Apart from the power setting, all settings are selected by pressing the M button on the multifunction steering wheel.

The following functions can be set:

EDC/Servotronic



Menu items:



Normal/Sport/Unchanged

The Normal and Sport characteristics of the Servotronic are linked to the EDC preselection.

DSC

Menu items: Off/On/M Dynamic Mode/Unchanged



E70/E71 M, M Drive menu, DSC setting options

Note: See dynamic driving systems for further information on EDC and DSC

POWER

Menu items: Efficient/Sport



E70/E71 M, M Drive menu, Power setting options

Since no Power button is installed, the power (program) selection "Efficient" or "Sport" is retained even after the engine is restarted and must be changed actively in the M Drive menu.

Head-up Display

Menu items: M View/Unchanged



E70/E71 M, M Drive menu, head-up display setting options

"Unchanged" in the EDC, DSC and Head-up display menus signifies that the current system setting is retained or remains unchanged when the M button is pressed.

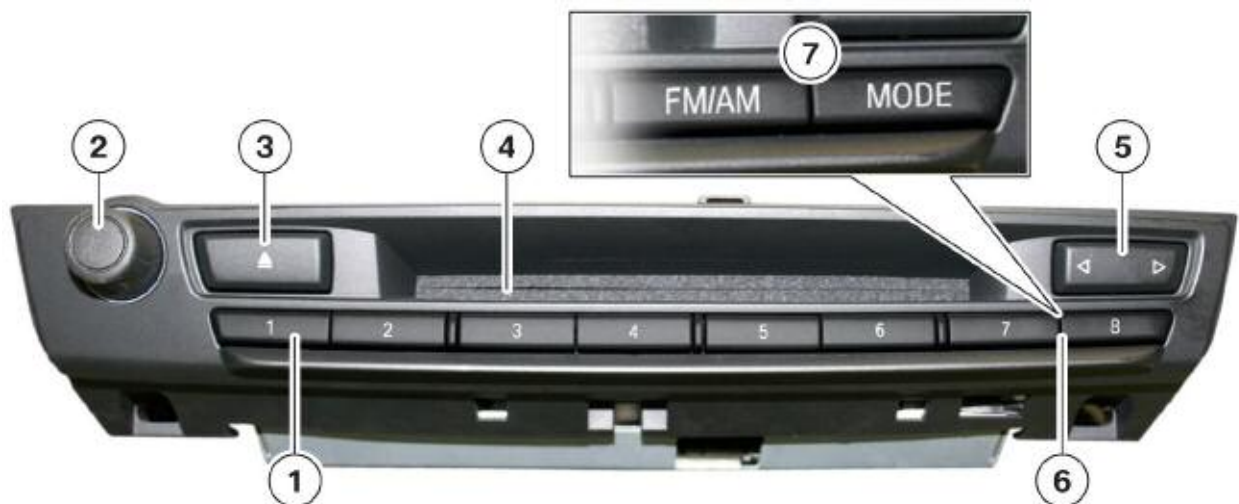
Car Information Computer (CIC)

The Car Information Computer was introduced in the BMW 1 Series and 3 Series during the second half of 2008. All other model series then followed except for the E7x models. As part of the 10/2009 model year updates the CIC is now also offered on E7x vehicles.

The E70/E71 M are the first X models to be launched with the Car Information Computer (CIC) including the M Drive menu. The CIC represents a consistent progression of the route laid down by the Car Communication Computer (CCC).

The main feature of the iDrive operating concept is the newly designed controller which now features short cut buttons. In addition, the complete layout of the user interface has been changed. Compared to the CCC, the number of drives in the CIC has been reduced to one DVD player.

CIC front view E7x



Index	Explanation
1	Favorite buttons 1-8
2	Rotary/pushbutton for controlling the volume of the audio system (On/Off switch)
3	Eject button for the DVD player
4	DVD drive slot
5	Station search/track "forward-back"
6	Favorite buttons 7 and 8 (Not for US)
7	US version with FM/AM buttons (frequency selection) and MODE (audio sources)

The navigation system of the CIC has been enhanced with many additional functions. Examples include full screen mode, night view and the 3D models in the perspective map view. This was realized by means of a hard disk that is capable of storing map data. Formerly, the map data had to be read separately from a DVD for each destination entry.

The hard disk in the CIC also makes it possible to create a play list for music data and a music track database (Gracenote®) to facilitate searching for music. A USB connection is provided and located in the glove compartment to import and export/back up data.

Several external receivers (e.g. IBOC, SDARS) and their functions have been realized in the CIC either by way of hardware or software, thus greatly expanding its functionality. An address database has been created in the "Contacts" submenu which can be accessed also from the telephone and navigation menu.

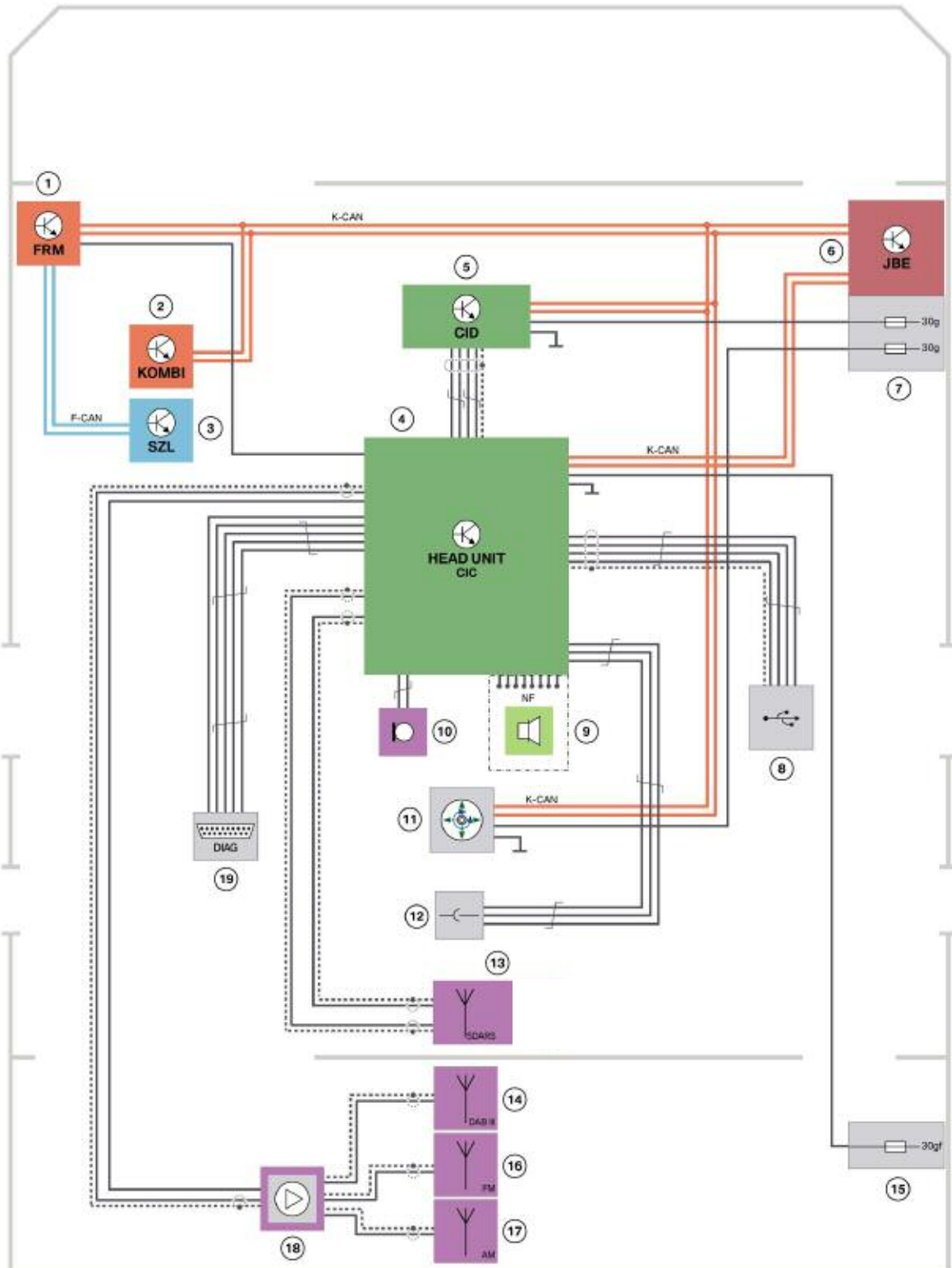
This innovation offers a wide range of options for future models. The communication service BMW Assist has been adapted to the new layout of the user interface and many additional services have been added (e.g. BMW Search and My Info [Google send to car]). The voice recognition system has been further developed to ensure voice input takes place even more smoothly.

The innovations introduced to the CIC system at the launch of the E7x models are listed in the following pages.

Note: For more information refer to the (CIC) Car Information Computer training material or the F01 Audio Systems training material available on TIS and ICP.

System Components

Circuit Diagram of Car Information Computer (CIC) in the E7x models



Index	Explanation
1	Footwell module
2	M Instrument cluster
3	Steering column switch cluster
4	Car information computer
5	Central information display
6	Junction box electronics
7	Junction box, front power distribution box
8	USB port in glove compartment for importing data
9	AF output for the speakers (stereo system)
10	Microphone, driver's side
11	Controller
12	Jack plug, AF input in center console for playback of audio files
13	SDARS antenna in roof fin
14	Not for US
15	Rear power distribution box
16	AM antenna
17	FM antenna
18	Antenna diversity module with integrated antenna amplifier
19	Diagnostic socket

New Features

Satellite Radio

With the introduction of the E70/E71 M to the US market in September of 2009, the hardware for the satellite tuner is integrated in the CIC. This newest version of CIC is as of now also installed in series production E7X vehicles. The satellite tuner in this CIC is referred to as In-Box SDARS and it allows the customer to activate the function with a valid enable code.

A new icon bar for the SDARS system provides additional functions:

- List view (select artists, title or channel)
- Categories of different genres
- Direct tuning of individual channels (e.g. Channel 6)
- Time shift (current program is buffered)
- Favorites storage
- Traffic jump (traffic information for a preferred region)

Change Between Different List Views



With this icon, it is possible to switch among all the available views of Satellite Radio (Long Channel Name, Artist and Song Title).

Select first icon in toolbar to switch to the next view



View of SDARS icon bar



Channel Name



Title



Artist



Channel name in parathesis indicate outdated PDT information.

Notable features of this function are:

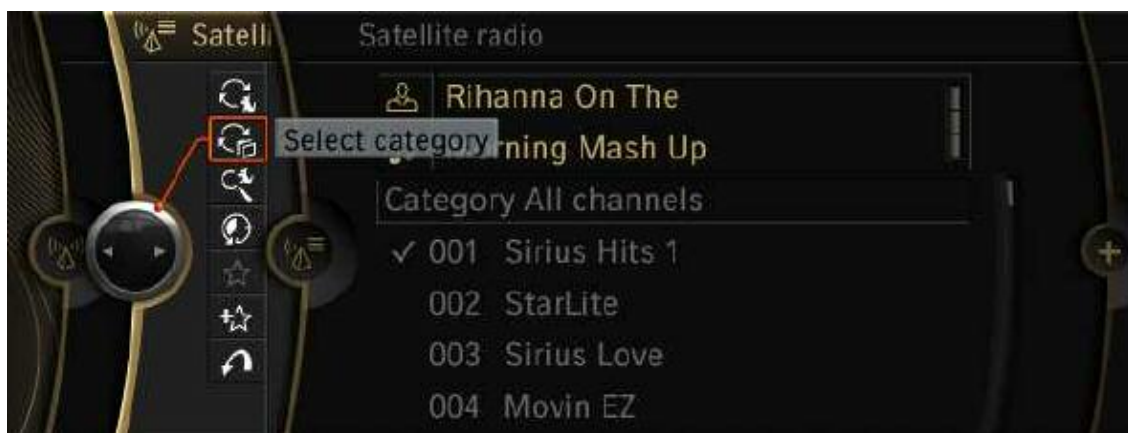
- The artist and title of active channel are shown in channel information.
- The name of active channel is shown in upper right corner (or "Acquiring" if no signal is available).
- The "active" channel is marked and if the channel is acquired, the proper save icon will be shown on the right side of the text.
- The "Live signal" bar is next to channel information (Extra Feature) if the tuner is in live broadcast and instant replay is not paused.
- If artist or title view is active and PDT information is outdated, the channel name will be displayed in parathesis. PDT information is outdated after four minutes without signal.

Category Lists



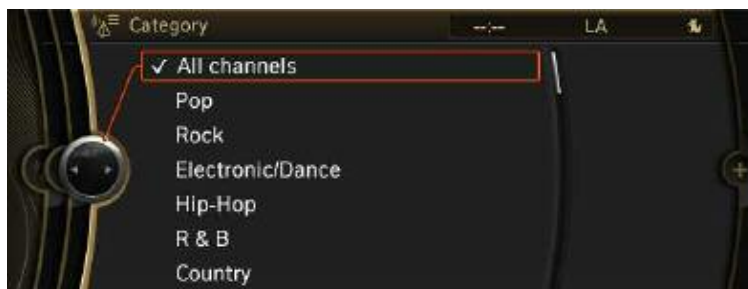
The channels broadcasted by SIRIUS are listed in different categories. There are also categories such as "My Favorites", "Unsubscribed channels" and "All channels" for which the number of channels can be changed dynamically. Categories can be selected either by pressing the second icon of the toolbar or selecting the header of the active channel list.

Categories can be selected by pressing the "Select category" icon.

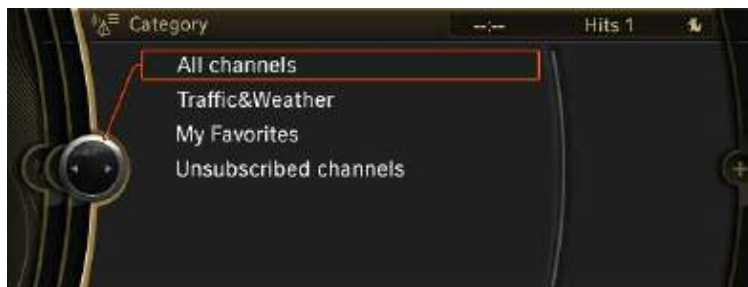




Categories can be selected by selecting the header of the active channel list.



The available categories are listed.



If the module is unsubscribed, only these four categories are available.

Notable features of this function are:

- The last active category is marked
- The name of active channel is shown in upper right corner (or "Acquiring" if no signal is available).
- The "Category" is displayed in status bar.

Direct Channel Tuning



By pressing the third icon of the toolbar, it is possible to enter the channel number directly with the controller. All subscribed channels can be tuned.

Only the channel number should be in red color when rotating controller to select channel.



Channel Skip

With the skip buttons of the steering wheel or the skip buttons next to CD slot, it is possible to skip to the next/previous subscribed channel in the current category. If a skip is issued at the end or beginning of a list, a wrap around in the active category in either direction must take place.

Note: If instant replay is active (visible in status bar), no new channel is tuned, but the previous or next track in the replay buffer will be played when the skip button is pressed.

Complete Channel Information

There exists the possibility to display all the details or PDT information (program descriptive text information) of the currently tuned channel under the options menu. This function is useful, if the channel information is too long (it contains an URL or phone number, etc.) for the channel info in the list view.

To access the channel info, select any channel and press option or shift the controller to the right to enter the options menu, then select Current Channel Details.



Current Channel Details in options menu.



PDT containing artist and title.

■ Entertainment Details in Splits Screen

A split screen containing the entertainment details can be activated in the SDARS options menu. The split screen contains channel name, artist and title.



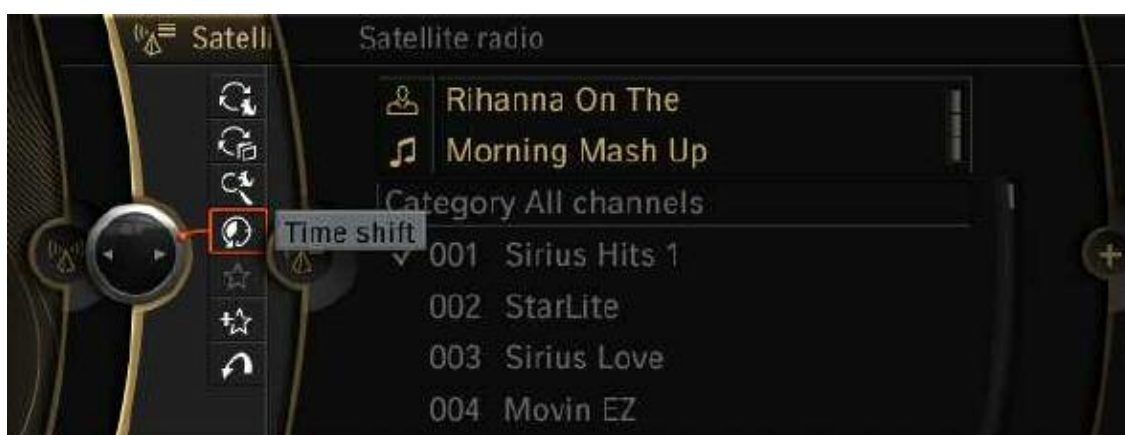
Split screen with "Entertainment Details".

Time Shift



The SIRIUS module allows to record approximately one hour of the current audio stream in a ring buffer. The recording time depends on the audio quality of the channel. The buffer will even be filled, if another audio source is active, but it is erased every time a new SDARS channel is tuned. The instant replay interface allows jumping in the buffer similar to CD playback (forward, rewind, skip song- and time-wise). Every time the audio does not reflect the live signal, an icon is displayed in the status bar and the current signal status is taken away.

Select the time shift icon in the toolbar to enter the instant replay menu.



Pause live broadcast or play/pause buffer.



Skip to next/previous title similar to CD playback.



Fast forward and rewind

Note: During buffer playback the time shift icon is displayed in the status bar.



Switch back to live broadcast.

Notable features of this function are:

- Skip buttons on steering wheel and the ones next to CD slot are used to skip to next or previous track in buffer.
- The status bar shows "Time shift", current time and the active channel.
- The artist and title of the played song must be shown.
- If live signal is played, signal status bar next to artist/title and the word "live" next to the buffer bar must be shown.
- The "Buffer Fill" pointer and current replay position (red arrow) define the offset to live signal. This offset is reported in hours, minutes and seconds. If playback is paused, this offset increases.
- If offset is zero, live signal is heard.
- If signal is lost the active channel is displayed and played as long as the buffer is filled. If offset is zero and signal is not available, "Acquiring" is displayed in status bar.
- If the buffer is full, the first track at the beginning of the buffer will be deleted.

■ Automatic Time Shift



If Automatic time shift is activated, the time shift status will change to pause, if the Source Activity status is paused. This happens if the entertainment button is pressed (mute) or if an incoming phone call is accepted.

Note: This function is available starting in 03/2010.



- Activated
- Automatic
- Time shift

Presets

There is a combined preset list available under the radio menu in which a maximum of 40 presets from different audio sources can be stored. The presets are key dependent and present in every new life cycle. There are different possibilities to store a channel in the preset list: Directly and via the options menu.



Tune a channel on the current list and press the controller.

OR

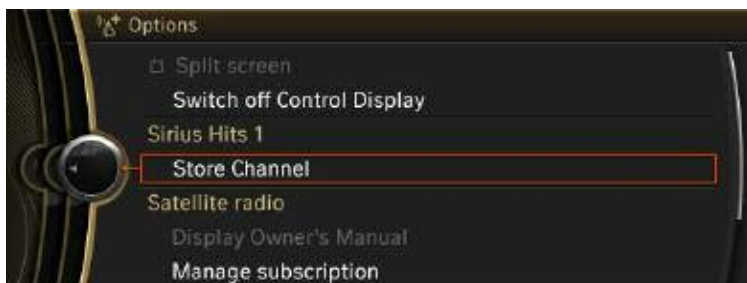


Highlight any channel of the active list and keep pressing the controller.



Confirmation to store the channel in the preset list is needed with those two ways of storing a channel. In this screen it is also possible to store favorites.

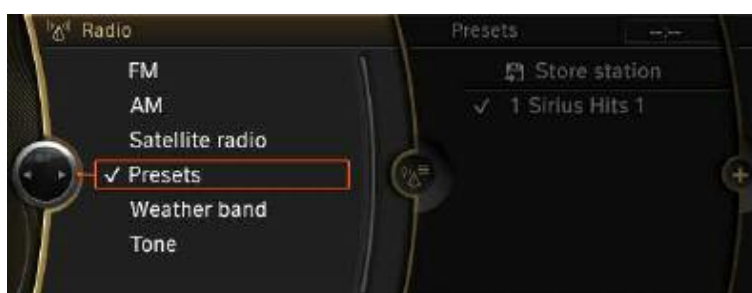
OR



Highlight any station and shift the controller to the right or press the "Options" button and select "store channel". This procedure leads directly to the "Preset List".



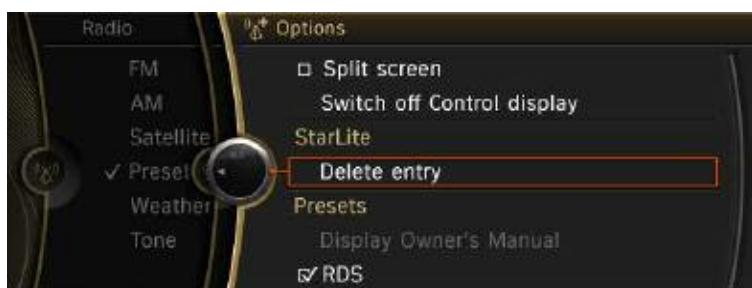
Now choose the position in which the channel should be stored.



To tune a preset enter the preset list and choose a preset.



“SAT” is written next to a stored SDARS channel in the presets list (or FM, AM depending on source).



To delete a preset, highlight the corresponding preset and press the option button, or shift the controller to the right, to enter the options menu.

Now delete the entry.

■ FBM List

The functional bookmark list contains channels that can be stored and recalled via the hard keys of the head unit.

Following additional functions can be stored in a FBM:

- Any toolbar icon, such as "Switch to next view" or "Choose Category".
- Any entry of the main radio menu, such as Satellite Radio or Presets.

Categories itself cannot be stored in a FBM.

Favorites



The fifth icon is a shortcut to "My Favorites" category. If the notification "Playing favorite" appears in the channel information panel, the toolbar icon changes to a double-star and the notified favorite will be tuned by pressing this icon. The notification will be active for 21 seconds. The category "My Favorites" is usually empty at startup and only shows those favorites that are currently on air.

As notification if a favorite (Artist, Song, Game, League, Team) is on air on any channel a star and "Playing favorite" appears in channel information panel with the icon of the corresponding match



Only the channels "My Favorites" which are broadcasting a favorite are shown. A channel will be kept in "My favorites" if it is tuned although the favorite (artist, title, etc.) isn't on the air any more.



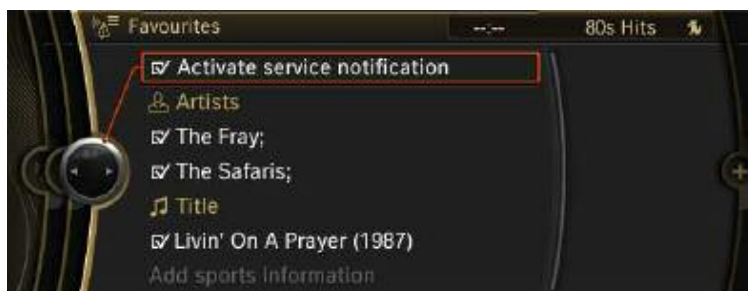
■ Manage Favorites



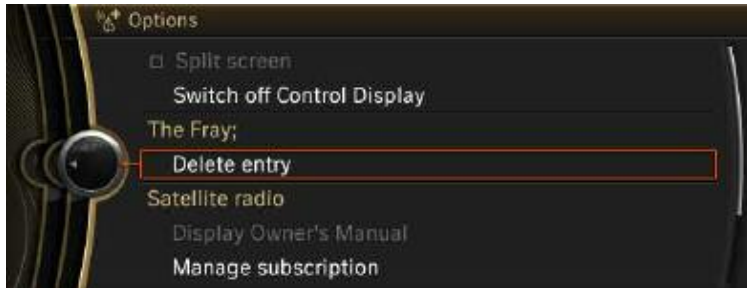
The stored favorites can be managed with the sixth icon of the toolbar. The seek functionality of Satellite Radio can be globally activated or deactivated as well as single entries. If it is activated, a pop up will appear to inform about broadcasted favorites. These entries can also be deleted because a maximum of 30 favorites can be stored



Favorites are managed by selecting this icon in toolbar.



Activate/Deactivate global favorite notification and/or single favorites. Notification is active when check-mark is present.



To delete an entry shift the controller to the right in the favorites options menu and select delete entry to remove it.

■ Store Favorites

The favorites are key dependent (PIA) and present in every new life cycle. The seek functionality of Satellite Radio allows storing a high variety of items such as:

- Artist
- Song
- Game
- League
- Team

These items can only be stored when they are broadcasted by SIRIUS. There are two ways to store an item in the favorites:

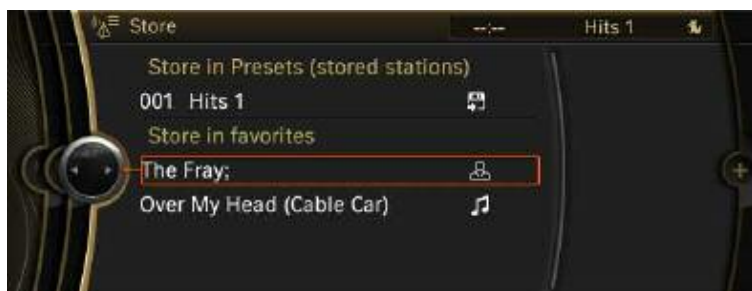


Tune a channel on the current list and press the controller.

OR



Highlight any channel of the active list and keep pressing the controller.

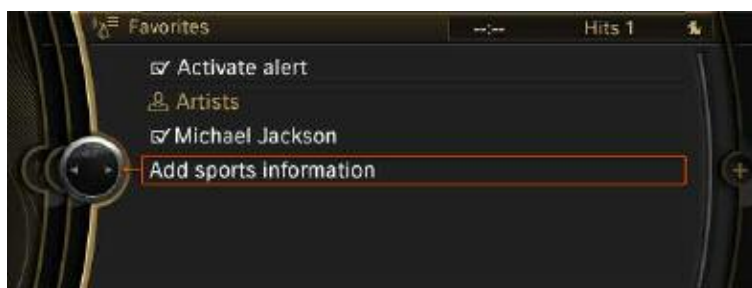


Store an item (Artist, Song,..) from the list in favorites. A favorite can only be stored, if this channel information is broadcasted and available.

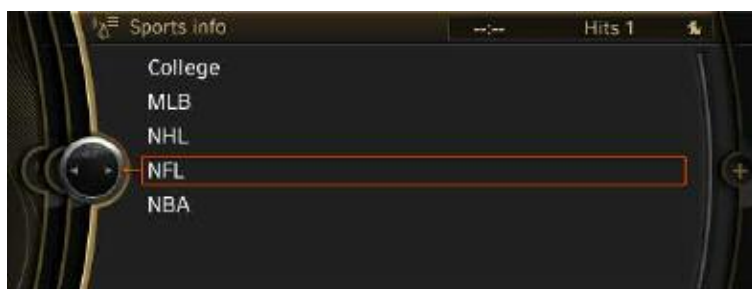
Note: If the maximum number of favorites is reached, a pop up will appear which leads to the manage favorites screen.

■ Store Team or League

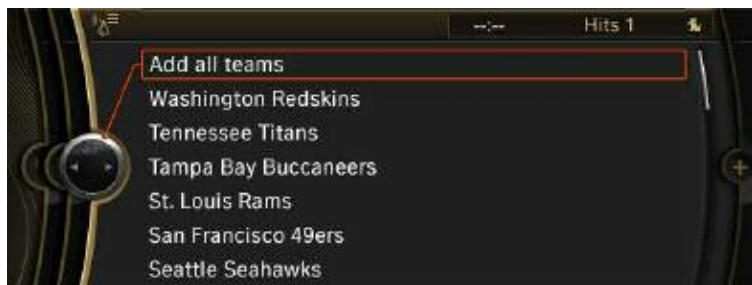
Besides artists and song titles also sport teams and leagues can be stored in the "Manage Favorites" screen.



Select "Add sports information" from the "Manage Favorites" panel.



Here we can choose a league.



The favorite team or all teams can be selected here.

Traffic Jump

This feature allows jumping automatically to a pre-selected traffic channel, if the traffic market is broadcasted.



Jump status idle - Traffic jump is deactivated.



Jump status pending - A traffic market is selected and the SDARS tuner is ready to jump.

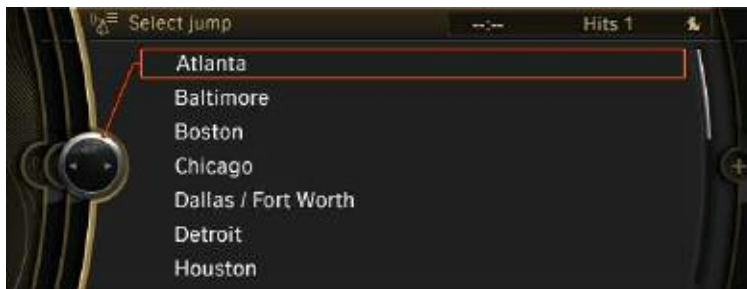


Jump status jumped - The selected traffic market is broadcasted.

If no traffic market has been selected before, a selection of the "Set Jump" toolbar icon opens a list of the available traffic markets.



To change a market for traffic jump, the "Set Jump" entry in the SDARS options is used.



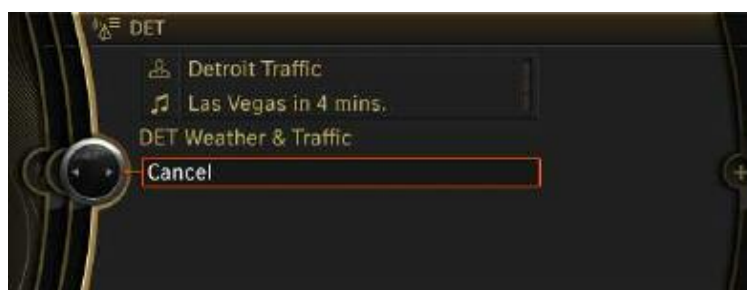
Names of all available traffic markets are shown in a list. The preferred region has to be chosen.



To activate traffic jump use the toolbar button "Jump to: < traffic market>". The status will be set to "pending" or, if a traffic market is broadcasted at this time, to "jumped".



To deactivate traffic jump use the toolbar button "Deactivate Jump". The status will be set back to "idle".



If traffic jump is active and traffic market is broadcasted, a pop up with the traffic information is shown. Traffic jump is deactivated (status back to "idle") using Cancel.

Traffic jump is activated (status jumped):

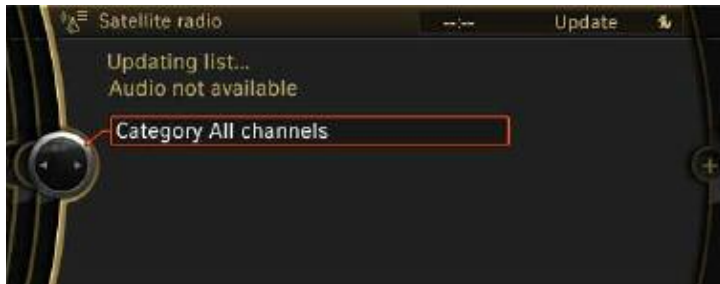
- if traffic information is broadcasted (pending -> jumped)
- if toolbar button "Jump to: Market" is selected (directly jump)

Deactivate active or pending jump, status changed to idle:

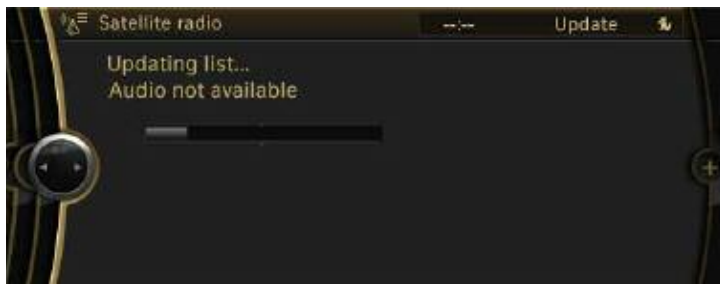
- by pressing “Cancel”
- if a GCI/PSV update is performed
- on tuner reset and power down
- if source is change
- if the channel that it is tuned to is the same that should be jumped to.

GCI Update

GCI stands for Global Channel Information. In a GCI Update the names of the channels and its positions can be changed. The GCI Update usually takes place twice a year when SIRIUS reconfigures its list.



GCI update is indicated through a pop up.



Progress of GCI update is indicated by progress bar.

While GCI update is performed:

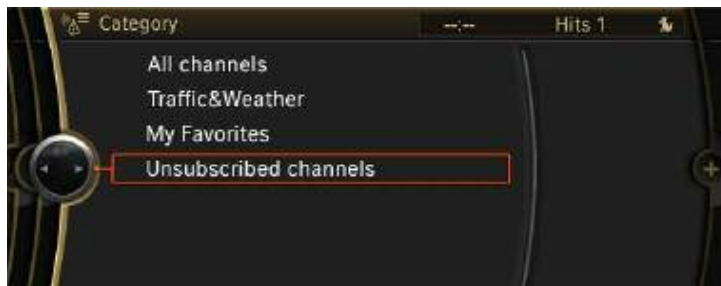
- Update is displayed instead of channel name
- Audio is muted

After GCI update is finished:

- “All Channel List”, Categories must be updated
- Last heard channel should be played or channel 184 (Weather) if last heard is not available any more
- Traffic jump channel list must be relearned
- Instant replay buffer must be deleted
- Filter settings of “Generic Lists” must be set to “All Channels”
- Category “My Favorites” must be cleared
- “Preset List” must be updated and presets which are no longer available must be removed.

Subscription (PSV) Update

The Subscription update or the so called PSV update (Program Subscription Vector) is performed when the customer communicates with SIRIUS to activate/deactivate the subscription or to change between the available packages.



Unsubscribed Channels are found in the corresponding category.



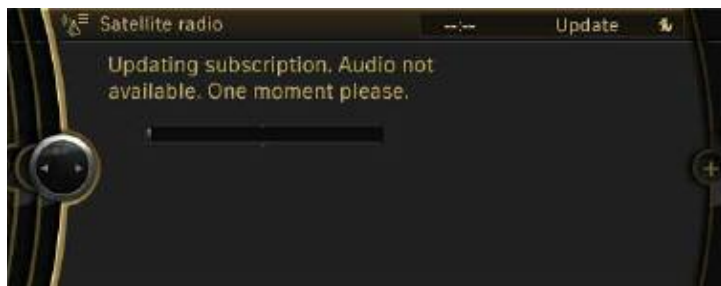
Unsubscribed icon is displayed next to the highlighted channel name.



12-digit ESN and phone number of SIRIUS hotline are shown if an unsubscribed channel is tuned. If a phone is paired, this phone number can be called directly by pressing the controller "Subscr. to Sirius" in status bar.



To change the subscription, the ESN and the SIRIUS phone number can also be found via the "Manage Subscription" entry in the SDARS options menu.



Updating subscription screen is shown while a PSV update is performed. A progress bar indicates the status of the update.

PIA (Personalization, Individualization and Adaption)

Globally configurations can be saved key dependently.
The following parameters are PIA relevant:

- Last heard station
- Preset List
- FBM List
- Selection of traffic market in the Traffic Weather List
- Global activation status of favorites
- The complete Favorite List

Navigation

New presentation view as satellite image. This feature can be activated in the options menu and is viewable from a scale >1 mls (2 km-1000 km). The resolution for selected core areas is 30 m/pixel. Central areas are shown at up to 100 m/pixel and areas at the edges at up to 500 m per pixel.



Navigation Satellite view

Voice Input

The trip planner can now be selected via the voice input function. A new feature of entering the destination using the voice input function is a structured selection menu to activate the correct entry by entering a number.



CIC voice input selection menu

User tracks of a play list/music search can now be voice-selected through genre, artist, album or track.